

# Risk Management in the Construction Project: Review

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**Abstract** - The construction projects are very much prone to risk and having the complexities in its activities. The dynamic project environment generates a risk that must be considered while decision making. This paper gives the review of fundamentals of risk management in a construction project. The explanation is given on the current practices of risk management and the most discussed subject among experts and researchers in the construction sector. This study is mainly a review of the literature; examines the literature related to the concept of risk, the management of risk in construction, as well as the methods used in the construction industry.

**Key Words:** Risk Management, Risk analysis, Risk Identification, Risk Control.

## 1. INTRODUCTION

Risk is defined as exposure of probability of occurrence of loss or gain with multiplication of its magnitude. If the probability of their occurrence is 100% then the risk is certain or if the probability of occurrence is 0% then risk is uncertain. In between the uncertainty varies. Nowadays, risk can be assessed using various types of information (Bon Gang and others, 2014). It is agreed by many people that Risk is more in business sector than any other sector. Every entrepreneurial act and a business decision are associated with risk. The risk is an occurrence that has a degree of obscurity and can either be positive or negative. A positive risk is a convenient opportunity, while a negative risk is a threat and hence inconvenient (Johnson T. 2008). Construction projects are always unique and risks arise from a number of the different sources (Oyegoke A.S. 2006). Construction projects are complex and dynamic as compared to other business sectors. Many people, individual and different organizations are included in the construction project, and their interests may be positively or negatively affected as a result of the project execution or project completion [Uher TE and others 2004]. All construction projects are hazardous by nature due to their configuration, financial and organizational arrangements, and technology and resource demands; hence, Risk Management in construction projects is dynamic rather than stagnant (Edwards P.J. & Bowen P.A., 2005). They argue that it is crucial for the industry to minimize these risks and uncertainties so as to unearth the impact thereof to determine which part of the project is more exposed to risk and less feasible. Risk

Management includes the identification of risks, calculating the probability and likely impact of the event, and treating risks and minimizing their impact with the minimum investment of resources. RM is being developed and employed in a lot of fields, such as environment, public safety, within enterprise management, and health care [Zayed and others, 2007]. This paper focuses on RM in construction Projects, argued that risk management when implemented, protects innovative projects, which are essential to gain competitive advantage and succeed in the market, but inevitably involve risky decisions and activities. Risk management could improve the ability to manage all stages of the innovative projects successfully. This paper was developed to clarify the basics of risk management through a short new suggestion of literature review for risk management. The main objective of this paper is to do research on risks in project and risk management procedure. The next section is devoted to the theoretical framework, including the definition of risk, risk management and risk management process.

## 2. LITERATURE REVIEW

### 2.1 Risks in construction

Construction industries in general as well as construction project activities are risky (Zavadskas and others, 2010). Risk in a construction industry is explained as in the form of positive or negative impact as a positive impact is nothing but a gain which happens because of risk and negative is loss because of the risk and takes place in micro and macro environments. Risk management is a system which aims to identify and quantify all risks, to which a project is exposed, so that a favourable decision can be taken against the risks (Markmann and others in 2013). PMBOK suggests risk management as one of nine focuses in project management and explains it in a very systematic way of identifying risk and mitigating it. It includes maximisation of the probability of happening of positive events and minimisation of the probability of avoiding or not happening consequences of events which may affect the objectives of the project. Risks comprise three groups: known risks, known unknown risks, and unknown risks (Smith N.J. and others, 2006). The first category includes minimal variations and often occurs and is inevitable features of construction works. The second category is foreseeable risk events with a known probability

of occurrence and impact The last category is those which, the probability of occurrence cannot be predicted.

The sub-categories of human risks associated with construction projects include technical, political, social, economic, legal, financial, health, managerial and cultural risks, grouped risk into ten categories, namely (Kishan P and others, 2014):

- Design: Defective design, inaccurate quantities, not coordinated design, rush design, awarding the design to unqualified designers, lack of consistency between bill of quantities, drawings and specifications
- Physical: Occurrence of accidents, because of poor safety procedures, supplies of defective materials, security of material and equipment, public security, varied labour and equipment productivity
- Logistics: Improper site investigation, inaccurate project program, unavailable labour, materials and equipment, high competition in bids, undefined scope of working, poor communications between the home and field offices (contractor side)
- Legal: Contractual anomalies, Claims and disputes, Vagueness of contract clauses, legal disputes during the construction phase among the parties to the contract, no specialized arbitrators to help settle fast, Low quality of the contract
- Environmental: Unpredictable Weather conditions, difficulty to reach at site due to weather ,environmental factor like floods, earthquakes, acid rain etc
- Construction: Gaps between the implementation and the specifications due to misunderstanding of drawings and specifications, actual quantities differ from the contract quantities, design changes, low quality work because of time limitation, bidding rush, change in order of undocumented work.
- Management: Poor communication between involved parties, ambiguous planning due to project complexity, changes in management ways information unavailability (include uncertainty), resource management
- Cultural: Religion, cultural custom
- Financial: Delayed payments on contract, unmanaged cash flow, inflation, financial failure of the contractor, exchange rate fluctuation, monopolizing of materials due to closure another unexpected political conditions
- Political: Changes in laws and regulations, inflation, Bribery, War and revolution, Restriction to foreign countries.

## 2.2 Risk management in construction

project risk management includes ( PMBOK 4<sup>th</sup> edition, 2008)

- Risk identification
- Qualitative risk analysis;
- Quantitative risk analysis;

- Risk response planning;
- Risk monitoring and control.

### 2.2.1 Risk identification (ID)

**a. Brainstorming:** This is most happening technique. it is used for idea generation; for an identification of risk this technique is useful. Relevant person of that project are gathered together and there is one facilitator who describe all the things and all experts are come on same decision and then unuseful risk factors are eliminated and the some missing factors are added.

**b. Delphi Technique:** This technique is near about same to brainstorming but the here the expert don't know each other. The facilitator takes the information from individual and then comes to some added conclusion with the help of an expert in one or more rounds.

**c. Interview/Expert Opinion:** By interviewing the experts which are working under same project and same kind of problems the risk factors are identified and this techniques is helpful in reducing the time require for risk identification.

**d. Past Experience:** Past experience from the same kind of project, for the same kind of project the analogy is formed and the characteristics of the project are compared and the risk factors are formed.

**e. Checklists:** In this technique the different risk factors are mentioned by studying the literature or past experience and simple checklist is constructed and final risk factors are selected by using the response of that checklist which is accumulated from the expert.

### 2.2.2 Risk assessment/analysis

**The various risk analysis techniques (Ward & Chapman, 1997)**

#### ▪ Quantitative Methods

**a. Sensitivity Analysis:** This is carried out to identify the uncertain project components which will have maximum impact on the outcome of the project. A risk model is prepared and a sensitivity analysis is carried out to check the sensitivity of different elements of the model on project outcome. To do these the values of one variable at a time is changed and the impact of these changes is then seen on the project.

**b. Scenario Analysis:** This gives the scenario of the different impacts which can occur. A fair decision can be made after this analysis, the option which will give lesser loss or hazards that option can be opted.

**c. Probabilistic Analysis (Monte Carlo Simulation):** A project simulation is done using a model to show the potential impact of different level of uncertainties on project objectives. Monte Carlo Simulation is generally used for this analysis. It can quantify the effect of uncertainties and risks on project budget and schedule. It simulates the full system

many times, each time randomly choosing a value for each factor from its probability distribution. It uses three-point estimates like most likely, worst-case and best-case duration for each task in time management.

**d. Decision Trees:** This analysis is carried out by decision tree diagram. Decision trees are very helpful to evaluate the option and to formulate it. In this analysis the graphical models which is used to represent a project and clearly reflect the effects of decision which are taken in every stage of the project.

These techniques are used for risk analysis; all these techniques are used in construction.

#### ▪ Qualitative methods

Qualitative methods for risk assessment are based on descriptive scales and are used to describe the probability and impact of a risk. These are relatively simple techniques that are used when rapid evaluation is required in small to medium-scale projects. In addition, this method is often used in the case of inadequate, limited or unavailable numerical data, as well as limited resources of time and money. They are listed as follows:

**a. Risk probability and its impact assessment:** Applying the method called risk probability and impact evaluation. The probability of an event occurring is calculated and then the impact of the risk on the objectives of a project is evaluated. The impact can be positive or negative. The positive impact increases the opportunities in a project and the negative impact produces threats in the project. The purpose of this evaluation is to find probabilities and adapt to a particular project. This means that clear definitions of scale must be developed and their scope depends on the nature, criteria and objectives of the project. PMI (Project Management Institute) identifies an exemplary probability range from "very unlikely" to "almost certain"; however, the corresponding numerical evaluation is admissible. The impact scale varies from very low to very high.

**b. Probability/impact risk rating matrix:** Probability and impact, which were assessed in the previous step, are used as a basis for quantitative analysis. In this method findings from the assessment are prioritized by using various methods and calculations which are found in literature. Westland computes the priority score as the average of the probability and impact. The range of priority score, the rating and color are assigned to indicate the importance of each risk. Threats with high impact and likelihood are identified as high-risk and may require immediate response, while low priority score threats can be monitored with action being taken only if, or when, needed.

#### **c. Risk categorization and Risk Urgency Assessment**

Risk categorization is a way to systematize project threats according to their sources, in order to identify the project areas that are most exposed to those risks. The tools that can be used in this method are the work breakdown structure

(WBS) or the risk breakdown structure (RBS), and its function is to develop an effective risk response. WBS decomposes large activities into small, manageable units and creates linked and hierarchical series of independent activities. RBS classifies the risks and shows their dependencies. The function of the second method, the Risk urgency evaluation, is to prioritize the risks according to the speed of response they require.

#### **2.2.3 Risk response Planning**

The response to risk is a central component in the RMP that determines what action (if any) will be taken to address the risks evaluated in the identification, qualification and quantification stages. According to the RR, actions are taken to eliminate, reduce or transfer a risk or its consequence. The risk response process includes the planning of a mandatory action that must be considered in the event of a risk event. It also involves taking the planned actions if necessary and monitoring the consequences of these actions to ensure that the risk plan results in the required result. The response to risk is determined by proposing several alternatives to eliminate or mitigate an anticipated risk and assign an optimal alternative as a response. According to RR, the "process of identification / development of risk response options and the determination of actions for the treatment of risk, the focus on improving opportunities and reducing threats to the objectives of projects". RR is, therefore, the selection of an appropriate policy to reduce the negative impact of a risk. Since the construction projects are distinctive, the risks involved are massive and dynamic in nature. Therefore, it is essential to invent adequate responses to these risks after the initial stages of identification, evaluation and risk allocation. RR was defined as the procedure of documents planned for RM that is used to manage the risk throughout the project. It is the stage that implies taking the appropriate measures to achieve the objectives of the project. Some studies recommend various response techniques in relation to the risks in the projects. He argued that there are four different ways to respond to risks in a construction project, namely: avoidance, reduction, transfer and retention of risks, while dividing the response techniques into three by combining avoidance and reduction. On the other hand, he indicated that risk responses can be grouped into mitigation or avoidance and acceptance.

#### **2.2.4 Risk monitoring and control**

Once the risks have been identified, evaluated and appropriate responses developed, those findings should be put into practice. Risk monitoring and control includes the implementation of the risk plan, which must be an integral part of the project plan. Two key challenges are usually encountered during monitoring and control; The first is to put risk plans into action and ensure they remain effective. The second is the production of meaningful documentation to support the process. The step in the description of the MR flow adopted in this study includes guaranteeing the use of

the previous steps. This is to ensure that the identified risks, which are considered important, are also controlled exactly in the way they were organized in the response step. In the control step, it is also possible to identify the new risks that arise and the continuous process. The objective of risk control is to control deviations, minimize risks and increase the value of the project. This stage of the RMP manages the risks so that the objectives of the project are achieved effectively. Risk control is based on a proactive approach that is not a reactive approach to implement the correct measures and refine them continuously. There are no prepared solutions available to minimize the risks. However, the following corrective measures can help manage the risks associated with construction projects:

- Adjust plans the scope of work and estimates to counter risk implications.
- Monitor risks regularly, evolve alternate plans to manage predictable risks, when needed.
- Make appropriate decisions.
- Keep all concerned informed about possible risks.

### 3. CONCLUSIONS

Although most of the studies have focused on some aspects of project management, this document has examined the literature related to risk management with the fulfilment of all the project's objectives in terms of cost, time, quality, medium environment and security. To achieve the objective of this study, the concepts of risk, RM and methods used to analyze / assess risk were reviewed. The literature showed that risk identification, risk analysis and evaluation, risk response and control are crucial stages in the risk management process. Risks must first be identified before they can be controlled or mitigated. Consequently, this study concludes that risk management should be considered as the most important activity for the successful completion of a project. The risk identification techniques that are concluded in this study include the following: brainstorming, interviews / expert opinions, questionnaires, Delphi technique, expert systems, checklists and review of documentation. In the risk analysis, two categories of methods are developed: qualitative and quantitative methods. The literature revealed risk avoidance, risk reduction, risk transfer and risk retention as techniques used primarily to respond to risk. The study also concludes that problems with possible threats contemplated in a project are not only a means to reduce losses within the project, but also a means to transfer risks to opportunities, which can lead to economic profitability.

### REFERENCES

- [1] Bon-Gang H., Xianbo Z., Ping T. L., "Risk management in small construction projects in Singapore: status, barriers and impact", International Journal of Project Management page no.116-124, 2014 <http://dx.doi.org/10.1016/j.ijproman.2013.01.007>
- [2] Johnson T. , "Project Management Professional (PMP) exam success series: certification exam manual", Texas: Crosswind Project Management Inc, 2008
- [3] Oyegoke AS.,"Construction industry overview in the UK, US, Japan and Finland: a comparative analysis", J Construction page no.13-31, 2006
- [4] Uher TE, Loosemore M., "Essentials of construction project management",Sidney: University of New South Wales Press, 2004
- [5] Edwards P.J. & Bowen P.A. , "Risk and risk management in construction: a review and future direction for research", engineering, Construction and architectural management, page no.339-349, 2005
- [6] Zayed, T. Amer, M. & Pan, J., "Assessing risk and uncertainty inherent in Chinese highway project using AHP", International journal of project management, page no. 408-419, 2007
- [7] Zavadskas, E. K.; Turskis, Z.; Tamošaitienė, J., "Risk assessment of construction projects", Journal of Civil Engineering and Management page no.33-46.<http://dx.doi.org/10.3846/jcem.2010.03>, 2010
- [8] Markmann, C.; Darkow, I.-L.; von der Gracht, H. , "A delphi-based risk analysis – identifying and assessing future challenges for supply chain security in a multi-stakeholder environment", Technological Forecasting and Social Change page no.1815-1833. <http://dx.doi.org/10.1016/j.techfore.2012.10.019>, 2013
- [9] Smith, N.J., Merna, T., & Jobbling P. , "Managing Risk in Construction Projects",2nd edition Oxford: Blackwell Publishing, 2006
- [10] Kishan P., Bhavsar, J.J., & Bhatt, R., "A Study of Risk Factors Affecting Building Construction Projects", International Journal of Engineering Research & Technology, page no. 831-835, 2014
- [11] Chapman C.B. and Ward S.C., "Project Risk Management: Process, Techniques and Insights", 2nd Edition, Chichester: John Wiley and Sons publication, , page no. 344 ,2003
- [12] Project Management Institute. Guide to the project management body of knowledge (PMBOK® Guide). 4th ed. Newtown Square: Project Management Institute; 2008